Improved Models for Prediction of Locally Intense Aeroacoustic Loads and Vibration Environments, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

ATA Engineering, Inc. proposes an STTR program to develop innovative tools and methods that will significantly improve the accuracy of random vibration response predictions for aerospace structures under critical inhomogeneous aeroacoustic loads. This will allow more accurate predictions of structural responses to be made, potentially reducing vehicle weight and cost and improving the reliability of these structures. Empirical wind tunnel test data will be used as a basis to develop innovative methods to characterize the surface fluctuating pressures encountered by launch vehicles during ascent, and then to accurately predict the random vibration environment caused by these loads. The wind tunnel test will measure both the surface fluctuating pressure and the resulting vibration in a flexible panel. Phase I will be spent performing pre-test engineering to reduce Phase II risk, generating drawings for construction of test articles, and deriving the test matrix for the Phase II wind tunnel test. The objective of Phase I is to demonstrate that the proposed Phase II wind tunnel test will be able to provide the test data necessary to improve predictions of fluctuating pressures and random vibration during ascent. Phase II will be used to perform the wind tunnel tests for compression corners, expansion corners, and protuberances. The vibration and fluctuating pressure data from these tests will be used to develop more accurate models to predict the auto- and cross-spectra of surface fluctuating pressures during ascent, followed by the development of coupling models to predict the resulting spacecraft structural vibrations. A critical improvement over current methods will be the inclusion of a statistical basis which will enable prediction of both mean and maximum expected environments. The experimental data in Phase II will also be made available to other researchers performing unsteady computational fluid dynamics simulations as validation data.

Improved Models for Prediction of Locally Intense Aeroacoustic Loads and Vibration Environments Project Image

Table of Contents

Improved Models for Prediction of Locally Intense Aeroacoustic Loads and Vibration Environments, Phase I

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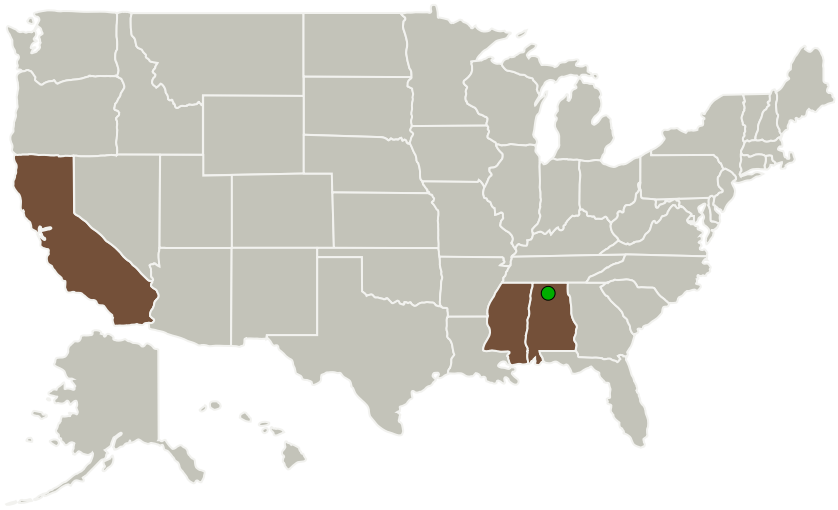
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
ATA Engineering, Inc.	Lead Organization	Industry	San Diego, California
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama
University of Mississippi	Supporting Organization	Academia	University, Mississippi

Primary U.S. Work Locations	
Alabama	California
Mississippi	

Project Transitions

June 2014: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ATA Engineering, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Michael Yang

Co-Investigator:

Michael H Yang

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December 2014: Closed out

Closeout Documentation:

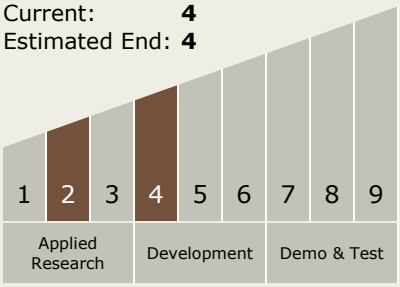
- Final Summary Chart*(https://techport.nasa.gov/file/140623)*

Images

Project Image
Improved Models for Prediction of Locally Intense Aeroacoustic Loads and Vibration Environments Project Image
(https://techport.nasa.gov/image/128470)

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.2 Structures
    - TX12.2.4 Tests, Tools and Methods

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System